Evidence-Based Medicine: KEY POINTS

Module 5: Variability and Error:

Random variability is inherent to measurement – we need to be aware of its presence, but there is nothing we can do about it.

Error, on the other hand, may either be **random** or **systematic**.

Random error arises as a function of the practice of sampling.

If we select a small sample, then it is possible that by chance alone, we select people who are not representative of the entire population.

Random error can be reduced by increasing the size of the sample that we

Random error does not arise from the "how" of sampling (i.e. how the sample is selected), but rather from the fact of sampling (i.e. measurements are from a subgroup of a larger population)

Systematic error (also known as Bias) distorts our measurements from the truth.

It can be minimized through careful study design.

Bias results from a systematic problem such that sample measurements will always deviate from the true population value

Bias cannot be addressed or fixed by increasing sample size or with any analytic technique

Types of bias

Selection bias

Referral bias (e.g., all participants recruited from a tertiary referral center)

Volunteer bias – people who volunteer to participate in clinical research tend to be younger, more active, less depressed, more motivated, etc.

Survivor bias – identification of the study population from amongst prevalent cases may favor selection of participants who have survived

Non-responder and/or drop-out bias – people who do not comply with study procedures may be different (e.g. sicker or healthier) from people who do

Misclassification bias (results from systematic inaccuracy in measurement)

Recall bias

Interviewer bias

Diagnostic bias (those with disease may be classified as not having disease (vice versa). Those with exposure may be classified as unexposed (vice versa)

Confounding is a mixing of effects that results in distortion of the relationship between exposure and outcome, but some third (extraneous) variable

(a) must be associated with the outcome in the absence of exposure, and

(b) must be associated with exposure, but not as a consequence of exposure (i.e. not an intermediary variable in the causal pathway)

If the potential confounder is not identified in the design phase, then it may be controlled for in the analytic phase of a study (an option that is not available for dealing with selection and misclassification biases). In the analytic phase, techniques such as **stratification and multivariate analysis** may be used.